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PORTABLE CATHODE-RAY ELECTROCARDIOGRAPH.

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RESTRICTED

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE

R E S T R I C T E D

PORTABLE CATHODE-RAY ELECTROCARDIOGRAPH, MODEL EKGS 27.

(Technological Physics Laboratory Karajan, Vienna).

Reported by

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PORTABLE CATHODE-RAY ELECTROCARDIOGRAPH, MODEL EKGS 21.

1. INTRODUCTION.

At the occasion of the ADRC team's visit to Vienna in September 1945, it was established that during the early months of 1945, Siemens and Halske had installed a test laboratory in Vienna which was engaged in the design and subsequently in the manufacture of a portable Electro-cardiograph unit to be used extensively by the Luftwaffe.

2. TARGET.

The investigation of the target revealed that such an establishment operated under the name of:

ING. WOLFGANG VON KARAJAN,
LABORATORIUM FUER TECHNISCHE PHYSIK,
WIEN 50, WIEDNER HAUPTSTRASSE 63.

3. INVESTIGATION.

On location, nothing but the empty building could be found and the interrogation of the porter at the premises indicated that the Russian occupying forces had evacuated all material which was left behind. Karajan, the nominal owner and director in charge of the laboratory had disappeared shortly before the Russians entered Vienna. He was supposed to have been actively engaged in Nazi Party affairs.

Eventually contact could be established with the former secretary, a Miss Fridtum, and Karajan's brother-in-law, Mr.Budeschowski. At the apartment of Budeschowski four units of the Cardiograph apparatus were found, one of which was removed and sent to USAFE (Main) at Wiesbaden for conveyance to the surgeon-general's office at Washington, D.C.

It was also ascertained that Karajan had gone to Grundlsee (Oberdonau) and a visit was made to his home there without success, inasmuch as he had left for Linz. The matter was turned over to Capt Work of USDIK (USFA) at Gmunden, who was requested to follow through on this

case and if possible collect available data pertaining to:

a. The actual use of the Electrocardiograph by the Luftwaffe.
b. Results obtained.
c. Practical applications in connection with aero-medical problems.

4. SUMMARY.

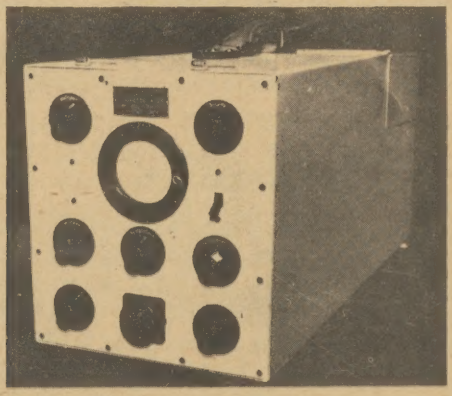
While no figures on production and costs could be established, the interrogation of Miss Fridtum and Mr.Budeschowski revaled that the OKL considered the apparatus a great innovation. The first shipments of machines were found to be very satisfactory and large orders were expected. While no information concerning similar American or British equipment was available to ask pertinent questions, it was believed that the information obtained and submitted herewith in this report would prove sufficient to enable expert personnel to evaluate the respective advantages of the model EKGS 21 which will be available for inspection at the Surgeon-General's office at Washington, D.C.

5. USE AND PURPOSE OF APPARATUS.

The desire to register Electrocardiograms not only photographically but also to follow them with the naked eye, led to the construction of the new Cathoderay-Electrocardiograph, Model EKGS 21. With the aid of this apparatus it became possible FOR THE FIRST TIME to recognise interesting changes of the Electrocardiogram during the actual origin and occurence and also to retain them photographically.

6. FUNCTION OF THE APPARATUS.

The graphic image of the visible curve of the Electrocardiogram takes place on the scope of a cathoderay-tube. On this scope, facing the observer, and as a consequence of clashing electrons, a closely defined light spot appears drawing the Electrocardiographic curve. In order to convey to the observer the impression of a closed curve, the scope of the Cathode Ray Tube is coated with a post-luminar layer. The motion of the light spot takes place in such a manner, that it moves from left to right across the center of the scope, thus drawing the curve until it gets to the extreme right edge from which position it automatically jumps back to the left edge, from where it continues registering. The post-luminar effect of the scope is calculated in such a way that the drawn curve has faded away before the light spot actually reaches the left edge. IN THIS MANNER A CONTINUOUS EKG TRACING presents itself to the naked eye.



FRONT VIEW

7. REGISTRATION.

A second Cathode Ray Tube placed inside the apparatus serves the purpose of photographically registering the electrocardiogram on a film-strip passing it by way of a special transport-mechanism. Through the use of two separate tubes it is possible to observe the EKG-tracing

without interruption. The registration can also be started or stopped at will by simply pressing a button.

The film transport is accomplished by a synchronous motor. In this manner the time indicator can be eliminated because the number of revolutions remains constant in the synchronous motor. The time markings are already incorporated in the sensitized emulsion of the EKG paper and are visible when developed. The usual time interval of 0.05 seconds between two adjoining lines was established. Every tenth line is a heavier one which facilitates the counting of larger intervals on the paper.

To compare the relative vertical range of the curve, a calibration of 1 millivolt can be photographed right on the film.

8. NET CONNECTION.

The necessary current for the operation of the apparatus is taken right from the net. No batteries are required, which in turn provides for a minimum of servicing. As an added safety-measure, the net connection is carried through a transformer. Standard types are constructed for use with alternating current. If direct current is to be used, an additional transformer is to be applied. On special request, battery units can also be furnished if electric current is otherwise not readily available.

9. COMPENSATION FOR INTERFERENCES.

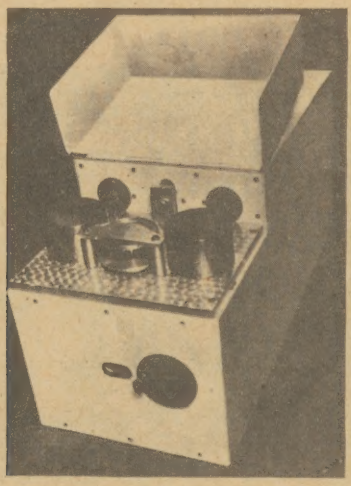
The most disturbing interference in the course of electrocardiographic processes is the effect of alternating fields (of the current of the net connection) upon the patient. This expresses itself in the well-known swelling savy zero line of the electrocardiogram and the deformation of the curve notches. In the same manner, knots of fine caliber disappear in this disturbance. To eliminate this short-coming, it is recommended to apply a safety screen to minimise these interferences.

Insofar as the EKGS apparatus is concerned, all these interferences are eliminated through a special compensation switch eliminating these disturbances right at the initial phase. It was thus accomplished to completely

eliminate the influence of outside (electric) fields in a most practical manner, and to obtain clean-cut curves even under most unfavorable conditions.

10. CONSTRUCTION.

The entire mechanism is placed in a metal container. The front view presents the observation scope and the necessary servicing knobs, which are furthermore protected by individual hoods in case the machine is to be moved from one place to another. The registration devices with the magazines are placed at the rear of the machine, and are easily accessible through lifting a cover at the back. This facilitates greatly the insertion and manipulation of films. Incidentally, all these manipulations can be executed in broad daylight, eliminating the necessity of dark rooms.

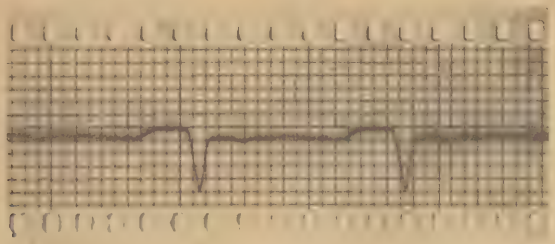


REAR VIEW

11. SERVICING.

The operation of the EKGS apparatus is quite simple and actually consists only of the adjustment of the knobs for the light spot, the adjustment of the vertical range of the EKG curve as well as the manipulation of the spped the light spot is moved about the scope of the cathode-ray tube. The unit is constructed in such a manner that no harm can be caused by improper manipulation. This is

supposed to be a considerable advantage on the part of the CATHODE-RAY ELECTROCARDIOGRAPH above the conventional cord type electrocardiograph.



12. POTENTIAL APPLICATIONS.

The obvious advantage of easy transportability is of primary importance to the practising physician. Another point is the easy method of manipulation. When using the EKGS Model No 21, the doctor will often find himself in the position to make a spot diagnosis on the basis of just viewing the heart tracing directly at the bedside of the patient, rather than to postpone a decision depending upon the ultimate development of the film. Generally speaking, it will be found in many cases that the physician will be able to refrain from taking photographic pictures altogether. This particular feature makes the EKGS apparatus particularly useful in connection with mass examinations or tests related to aero-medical or sports-medical phenomena.

The direct viewing of the EKG-tracing with the naked eye represents in itself an entirely new range of various potential applications. First of all, the apparatus will be extremely useful when tests or clinical observations have to extend over any length of time, in the course of which electrocardiographic control is desirable or necessary. In such cases, a precise and immediate observation of heart phenomena can be accomplished. Furthermore, the opportunity is given to retain distinct phases of the observations photographically.

The unit will enable the physician to determine variable changes in the P.R.-interval, clots and widenings of the QRS complexes and distortions and their respective appearances as a consequence of narcotic damages or myocardio-damaged patients during the operation RIGHT AT THE VERY

MOMENT OF THEIR APPEARANCE. This in turn will enable the physician to avoid a dangerous intensification, and through proper measures, eliminate dangerous consequences. The average type electrocardiograph actually only permits determining the occurring damage AFTER SUCH DAMAGE HAS TAKEN PLACE, because one cannot observe the EKG-tracing at the moment of its origin because one has to wait in each instance for the complete development of the film before a decision can be made.

Thus, for instance, the condition of the conduction system of the heart during the insulin shock, the development of heart paroxysm or even rare extra systoles, can be observed and the effective efficiency degree of theraputic relation can be determined in an exact measure even in connection with heart remedies administered perorally.

An excellent application of the EKGS apparatus is the determination of chest disorders, because while tapping the chest with the thoracalic electrode, the scope will show the EKG curve, and the necessity of taking pictures and developing the same can be eliminated. Final reference can also be made to the pictorial representation of the electrocardiogram for lecture purposes.

13. TECHNICAL DATA.

MEASUREMENTS:	270x610x300 mm.
WEIGHT:	25 kg.
DIAMETER OF VIEWING SCOPE:	70 mm.
AMPLIFIER:	4 stages with constant maintenance of timing, full net connection, compensation switch for interferences, variable volume control.
REGISTRATION SURFACE:	35 mm paper positive film in rolls up to 15m length with longitudinal and vertical line raster.

TIME MARKING:	0.05 seconds between two neighboring lines. Every 10th line appears heavily enlarged.
REGISTRATION SPEED:	38 mm per second.
VOLTAGE:	110/220 Volts AC.
PERIODS:	50 Hc.
STANDARD ACCESSORIES:	One magazine for unexposed film, one magazine for exposed film, one spool EKGS registration paper, three plate electrodes, one net cable, one contact cable for connection with the patient, and instruction sheet.